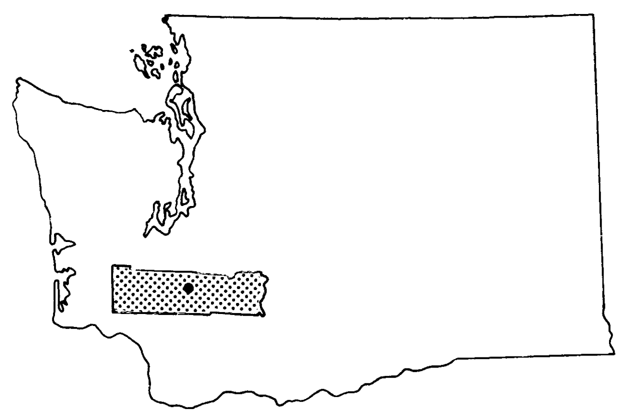
FLOOD INSURANCE STUDY

TOWN OF VADER, WASHINGTON

LEWIS COUNTY



MARCH 1979

U.S. DEPARTMENT of HOUSING & URBAN DEVELOPMENT
FEDERAL INSURANCE ADMINISTRATION

TABLE OF CONTENTS

TABLE OF CONTENTS (cont'd)

FLOOD INSURANCE STUDY

1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Flood Insurance Study is to investigate the existence and severity of flood hazards in the Town of Vader, Lewis County, Washington, and to aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of this information will be to convert Vader to the regular program of flood insurance by the Federal Insurance Administration. Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain development.

1.2 Coordination

Streams selected for detailed analysis were identified in a meeting attended by representatives of the community, a study contractor formerly identified to perform the study but not subsequently brought under contract, and the Federal Insurance Administration on April 14, 1976. A later meeting was attended by representatives of the county, the study contractor that was eventually selected, and the Federal Insurance Administration on July 6, 1976.

During the course of the work, numerous informal contacts were made by the study contractor with the community for the purpose of obtaining data and acquiring base map material.

This report incorporates resolution of all comments received as a result of coordination activities.

The results of this study were reviewed at a final community coordination meeting held on September 5, 1978. Attending the meeting were representatives of the Federal Insurance Administration, the study contractor, and the city. This study incorporates all appropriate comments, and all problems have been resolved.

1.3 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

The hydrologic and hydraulic analyses for this study were performed by Tudor Engineering Company, for the Federal Insurance Administration, under Contract No. H-4025. This work, which was completed in April 1978, covered all significant flooding sources affecting the Town of Vader.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Vader, Lewis County, Washington. The area of study is shown on the Vicinity Map (Figure 1).

Floods caused by the overflow of Olequa and McMurphy Creeks were studied in detail.

Those areas studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1983.

2.2 Community Description

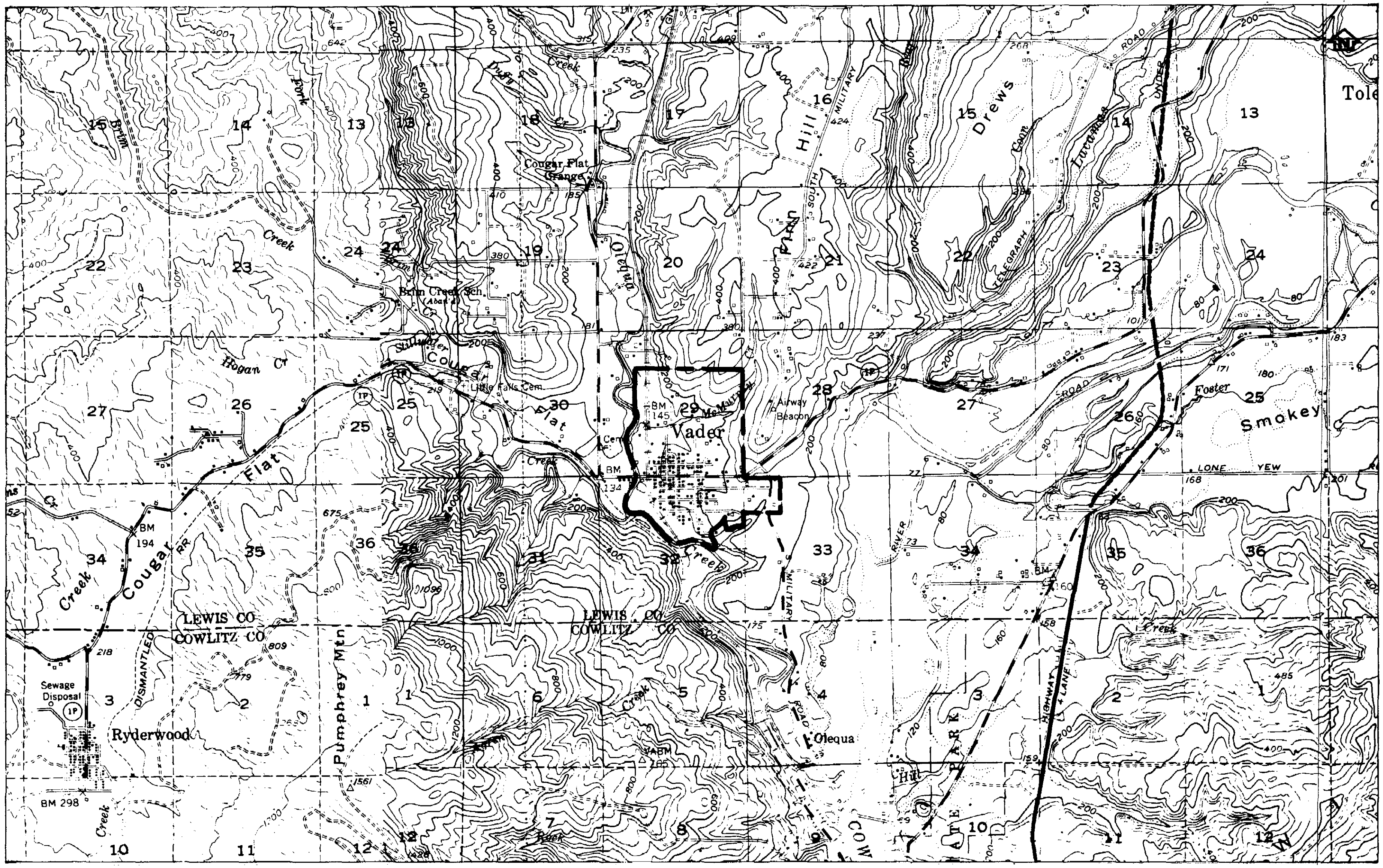
Vader is located in southern Lewis County, in southwestern Washington, approximately 18 miles south of Chehalis and 1 mile north of the Cowlitz County line. It is approximately 3.5 miles west of Interstate 5 on State Road 603.

Vader was incorporated as Little Falls on January 3, 1906. On March 25, 1913, the name was changed to Vader. Of the nine incorporated municipalities in Lewis County, Vader is now the smallest. The population of Vader decreased from 631 in 1910 to 387 in 1970. Since 1970, its population has slowly increased to an estimated 400 in 1975 (References 1 and 2).

The economy of Vader, and Lewis County in general, depends heavily on the lumber and wood products industry which comprised 75 percent of the total manufacturing employment of the county in 1976.

Vader has a mid-latitude, west coast, marine type climate, typified by dry, cool summers and mild, wet, and cloudy winters. The average annual precipitation is approximately 50 inches; however, less than 1 inch normally falls in each of the months of July and August.

Average afternoon wintertime temperatures range from a low near 25°F to a high of approximately 45°F. Normal summertime temperatures range from 70°F to 80°F, reaching 90°F or higher on from 5 to 15 days and 100°F or higher in 1 out of 4 summers. Minimum summertime temperatures range from the mid-forties to the mid-fifties. The average annual snowfall is light and seldom remains on the ground longer than 1 week or reaches a depth in excess of 8 to 12 inches (Reference 3).



DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT Federal Insurance Administration	APPROXIMATE SCALE 1 0 1 2 3 MILES
TOWN OF VADER, WA (LEWIS CO.)	**VICINITY MAP**

FIGURE 1

Olequa Creek and its tributaries upstream of Vader drain an area of approximately 59 square miles. Olequa Creek originates in the area known as Jackson Prairie. It runs southwestward through Winlock, then flows south through Vader, eventually emptying into the Cowlitz River, approximately 2 miles south of Vader.

Altitudes range from approximately 500 feet on Jackson Prairie to approximately 80 feet at its confluence with the Cowlitz River.

McMurphy Creek originates northeast of Vader and drains into Olequa Creek within the corporate limits of Vader. It is a small creek, and drains an area of approximately 1 square mile.

There is very little development within the flood plains of either Olequa or McMurphy Creeks.

2.3 Principal Flooding Problems

The Town of Vader has no recorded history of major floods. However, interviews with local residents have determined that some flooding occurred in 1970-71 from McMurphy Creek.

2.4 Flood Protection Measures

There are no existing flood protection measures in Vader.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded <u>once</u> on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term <u>average</u> period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual occurrence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each stream studied in detail in the community.

No streamflow records are available for either Olequa or McMurphy Creeks. Runoffs for the floods of the selected recurrence intervals were calculated using rainfall-runoff relationships developed for the area and a computerized storm water routing model. The model incorporates the unit hydrograph methodology developed by the U.S. Soil Conservation Service (Reference 4).

The 24-hour duration storm precipitation volumes for 10-, 50-, and 100-year return storm frequencies were obtained from the National Oceanic and Atmospheric Administration Atlas 2 frequency curve on normal distribution probability paper (Reference 5). The intensity distribution was based on Castle Rock rainfall gage records.

Peak discharge-drainage area relationships for Olequa Creek and McMurphy Creek are shown in Table 1.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of streams in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each stream studied in the community.

Water-surface elevations were computed using the HEC-2 step-backwater computer program (Reference 6).

Aerial photographs, contour maps, and cross section data were provided by Towill, Inc., under subcontract to the study contractor (References 7 and 8).

All bridges and culverts were field surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Channel and overbank roughness factors (Manning's "n") are based on field inspection and photographs at each cross section location. Channel roughness coefficients ranged from 0.045 to 0.055; an overbank coefficient of 0.200 was also used.

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
Olequa Creek					
At Downstream Limit of Study	106.9	5,220	8,700	10,190	14,400
At Confluence With Stillwater Creek	102.2	5,130	8,550	10,020	14,180
At Confluence With McMurphy Creek	60.2	2,345	4,070	4,740	6,920
McMurphy Creek					
At Confluence With Olequa Creek	1.05	85	130	160	220

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

Starting water-surface elevations for the creeks were computed by the slope-area method.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage State and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Insurance Administration as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4800, with a contour interval of 4 feet (Reference 8).

In cases where the 100- and 500-year flood boundaries are close together, only the 100-year flood boundary has been shown.

Flood boundaries for the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2).

Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity and increases flood heights, thus increasing flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment in order that the 100-year flood be carried without substantial increases in flood heights. As minimum standards, the Federal Insurance Administration limits such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced.

The floodways developed in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood boundaries are close together, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WITH FLOODWAY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	DIFFERENCE
Olequa Creek							
A	2.79	115[2]	1425	7.0	101.2	100.9	0.3
B	2.99	137[3]	1463	6.8	103.3	102.9	0.4
C	3.06	168[3]	2140	4.7	104.3	104.0	0.3
D	3.09	150[3]	1243	8.1	104.3	104.0	0.3
E	3.45	140[3]	1579	6.3	110.2	109.9	0.3
F	3.72	48[3]	597	7.9	115.3	114.9	0.4
G	3.80	92[3]	1115	4.3	116.7	116.2	0.5
H	3.84	52[3]	667	7.1	116.8	116.3	0.5
I	4.21	80[3]	787	5.7	122.0	121.0	1.0

[1] Miles Above Mouth [2] Width Lies Entirely Outside Corporate Limits [3] Width Extends Beyond Corporate Limits

TABLE 2

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

TOWN OF VADER, WA
(LEWIS CO.)

FLOODWAY DATA

OLEQUA CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	WITH FLOODWAY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	DIFFERENCE
McMurphy Creek							
A	0.222	41	25	4.5	136.8	136.8	0.0
B	0.245	55	62	1.8	139.6	138.7	0.9
C	0.292	74	82	1.3	142.3	141.3	1.0
D	0.306	60	80	1.4	146.8	145.8	1.0
E	0.332	35	128	0.9	148.0	147.0	1.0
F	0.413	14	33	4.2	149.0	148.8	0.2
G	0.432	47	150	0.9	151.7	151.5	0.2
H	0.445	40	28	5.0	152.1	152.1	0.0
I	0.466	50	79	1.8	154.3	154.3	0.0
J	0.523	23	24	5.8	159.3	159.3	0.0
K	0.690	30	34	4.1	186.1	185.7	0.4

[1]Miles Above Confluence With Olequa Creek

TABLE 2

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

TOWN OF VADER, WA
(LEWIS CO.)

FLOODWAY DATA

McMURPHY CREEK

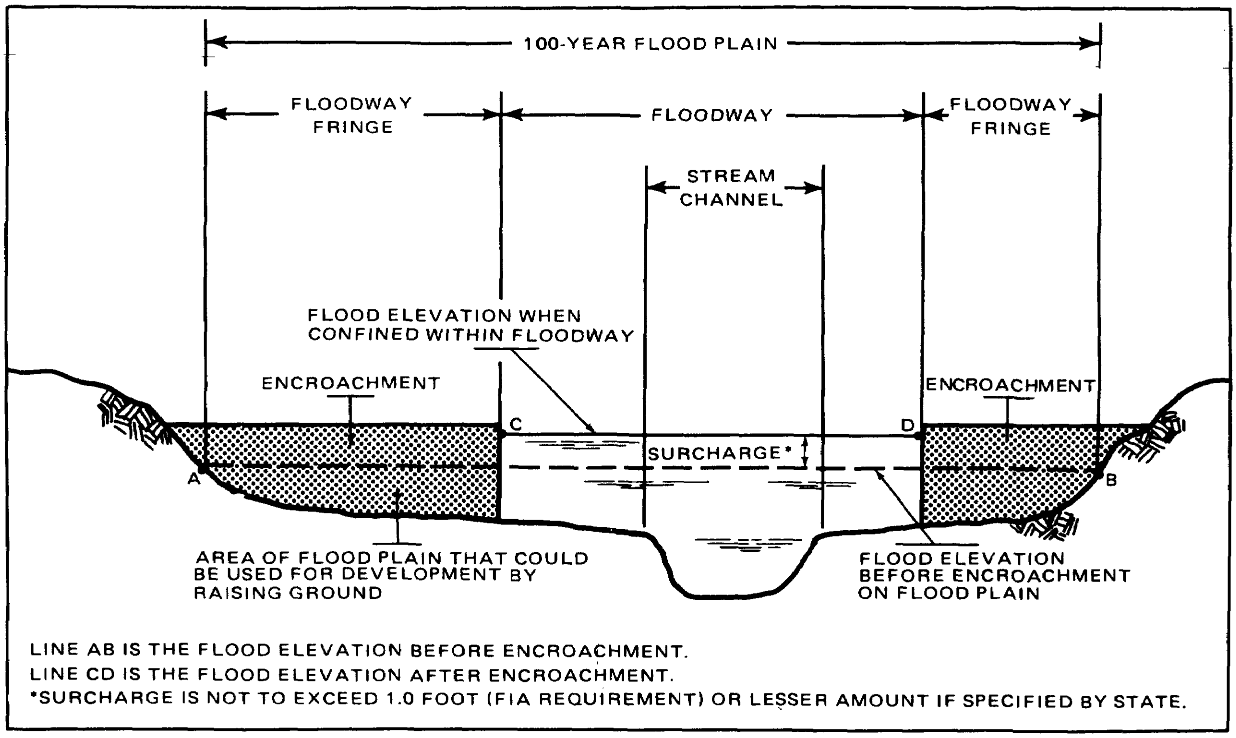


Figure 2. Floodway Schematic

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the Federal Insurance Administration has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting the Town of Vader.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot

Two reaches meeting the above criteria were required for the flooding sources of the Town of Vader. These included one each on Olequa and McMurphy Creeks. The locations of the reaches are shown on the Flood Profiles (Exhibit 1).

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is the Federal Insurance Administration device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective Flood Hazard Factors, the entire incorporated area of the Town of Vader was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zones A1 and A8:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to Flood Hazard Factors.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

The flood elevation differences, Flood Hazard Factors, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are summarized in Table 3.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Vader is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the Federal Insurance Administration.

6.0 OTHER STUDIES

No studies by other agencies have been published for the area covered.

This study is authoritative for the purposes of the National Flood Insurance Program; data presented herein either supersede or are compatible with all previous determinations.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Federal Insurance Administration, Regional Director, Arcade Plaza Building, 1321 Second Avenue, Seattle, Washington 98101.

8.0 BIBLIOGRAPHY AND REFERENCES

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2. Washington State Planning and Community Affairs Agency, Growth of Cities and Towns, State of Washington, Calvin F. Schmid and Stanton E. Schmid, Olympia, Washington, 1969

3. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service, Climatography of the United States No. 60-45, Climate of Washington, Earl L. Phillips, Silver Spring, Maryland, February 1960 (Revised April 1965)

4. U.S. Department of Agriculture, Soil Conservation Service, Technical Release No. 20, Computer Program for Hydrology, Washington, D.C., May 1965

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (FEET NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Olequa Creek Reach 1	0001	-3.97	-1.02	2.84	040	A8	Varies - See Map
McMurphy Creek Reach 1	0001	-0.58	-0.13	0.38	005	A1	Varies - See Map

[1]Flood Insurance Rate Map Panel [2]Weighted Average [3]Rounded to Nearest Foot

TABLE 3

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

TOWN OF VADER, WA
(LEWIS CO.)

FLOOD INSURANCE ZONE DATA

OLEQUA CREEK – McMURPHY CREEK

5. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Atlas 2, Precipitation-Frequency Atlas of the Western United States Volume IX - Washington, 1973

6. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Generalized Computer Program, Davis, California, October 1973

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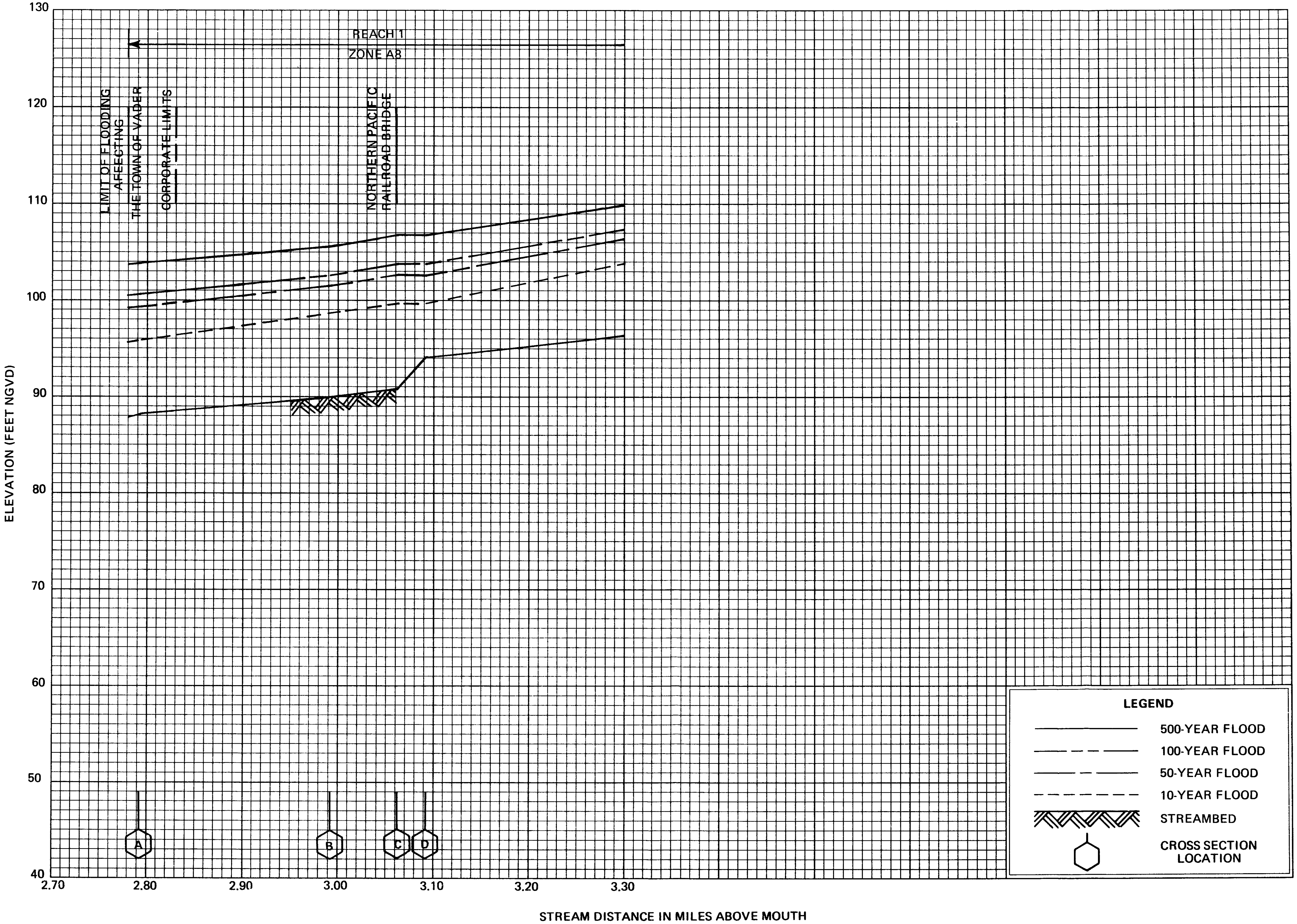

FLOOD PROFILES

OLEQUA CREEK

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

TOWN OF VADER, WA
(LEWIS CO.)

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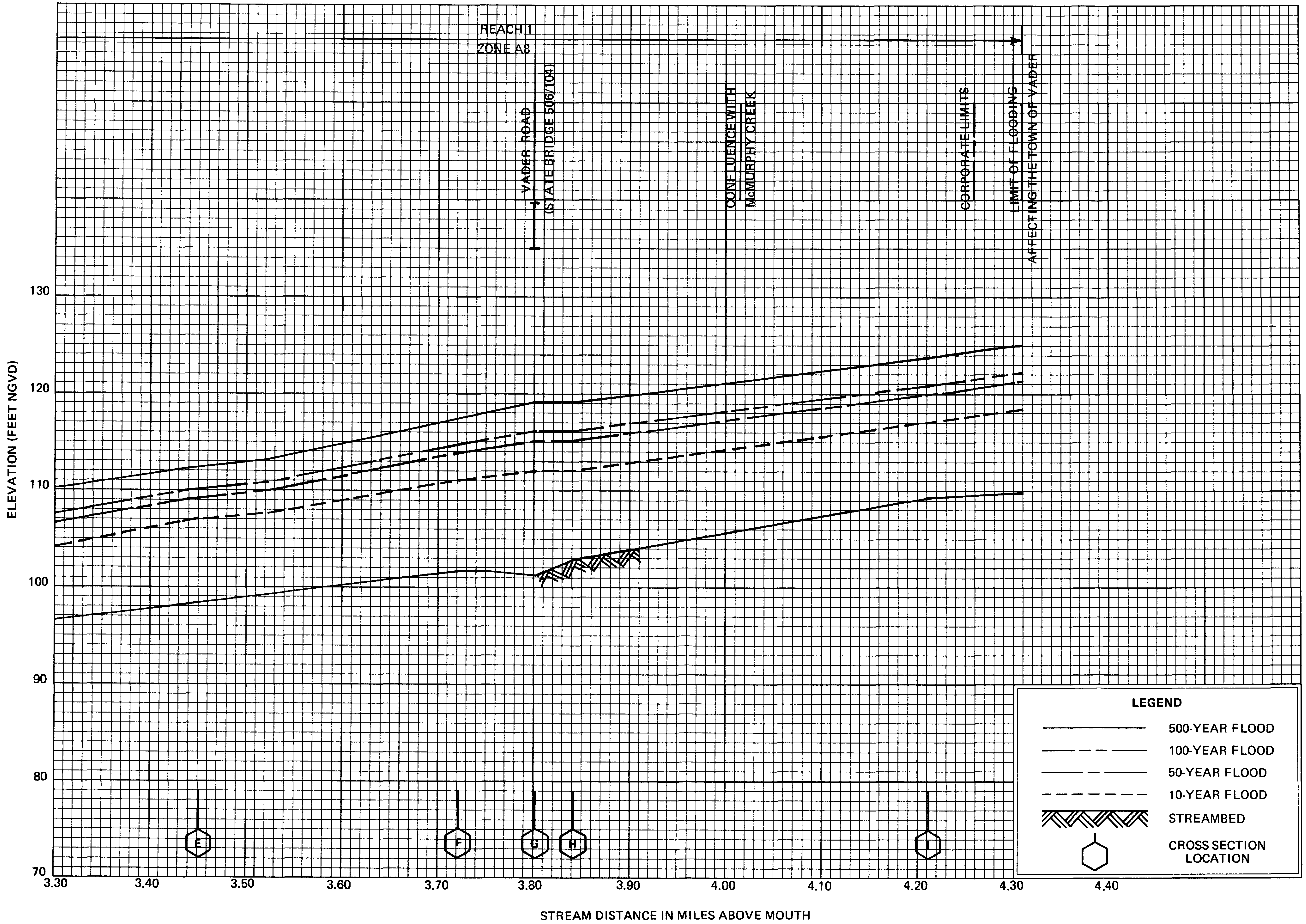

FLOOD PROFILES

OLEQUA CREEK

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

TOWN OF VADER, WA
(LEWIS CO.)

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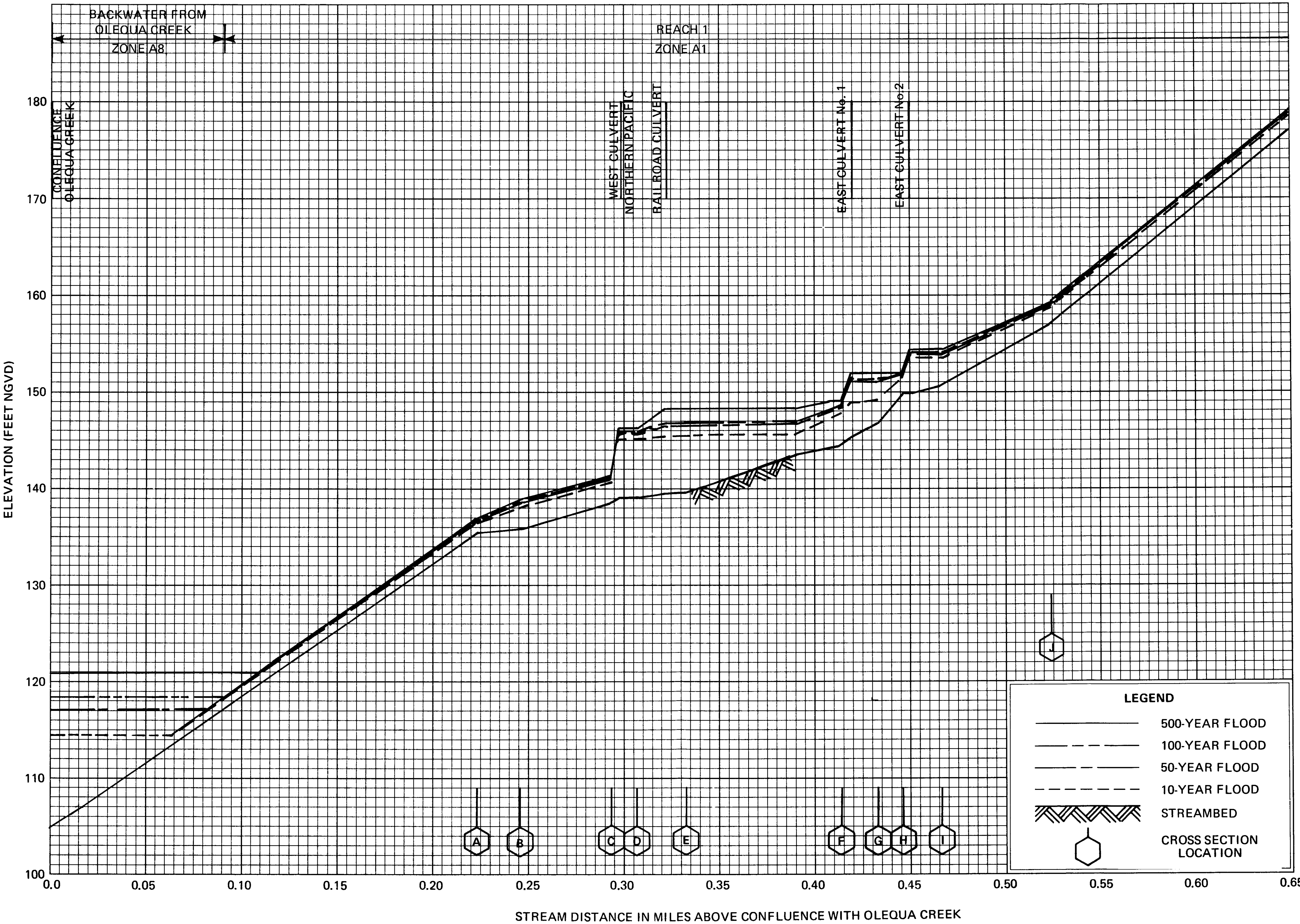


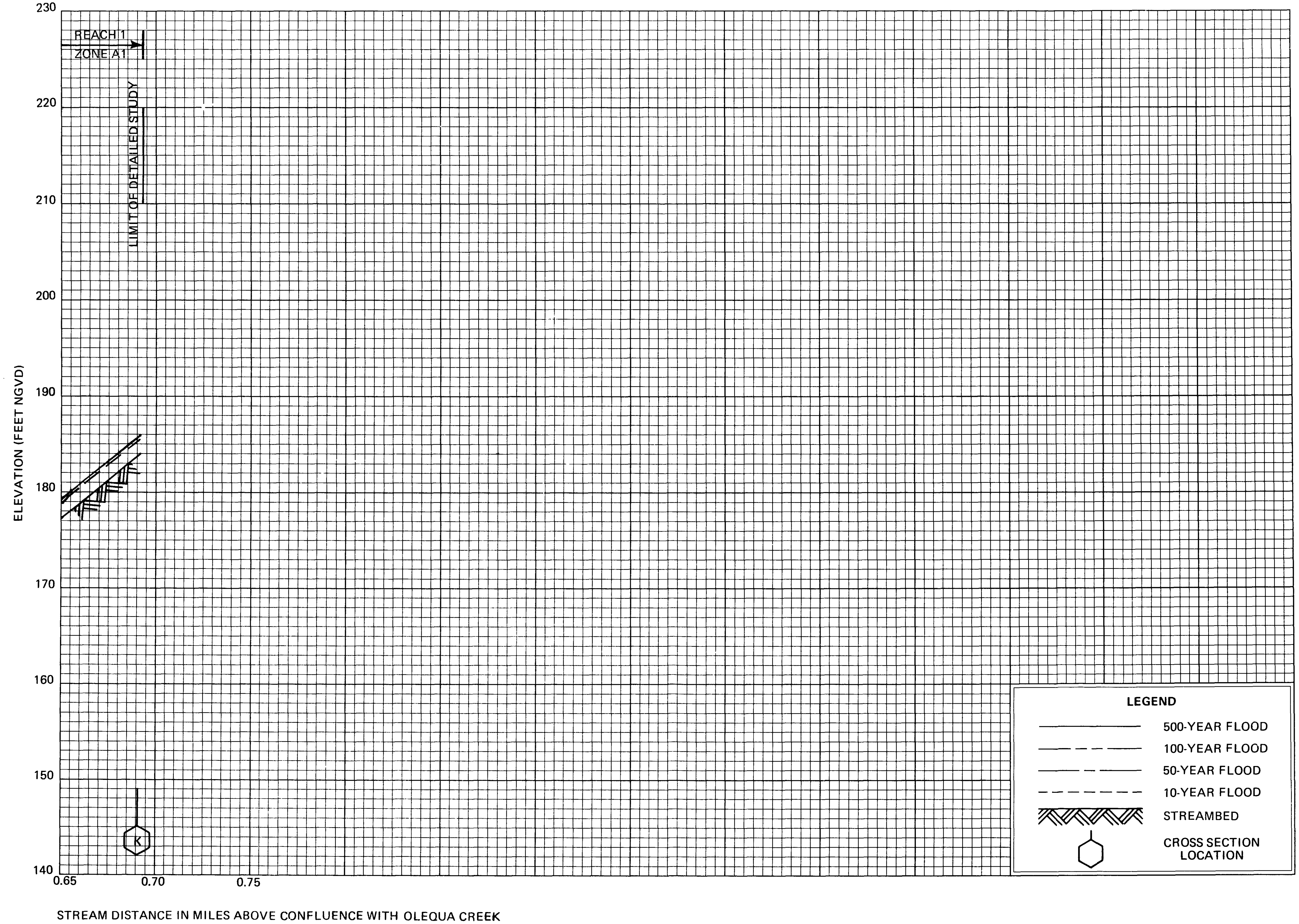
FLOOD PROFILES

McMURPHY CREEK

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

TOWN OF VADER, WA
(LEWIS CO.)

03P



FLOOD PROFILES

McMURPHY CREEK

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
Federal Insurance Administration

TOWN OF VADER, WA
(LEWIS CO.)

04P